

## § 655.606

## 23 CFR Ch. I (4–1–14 Edition)

630, subpart A, Federal-Aid Programs Approval and Project Authorization. Simplified and timesaving procedures are to be used to the extent permitted by existing policy.

(b) *Off-system highways.* Certain federally funded programs are available for installation of traffic control devices on streets and highways that are not on the Federal-aid system. The procedures used in these programs may vary from project to project but, essentially, the guidelines set forth herein should be used.

### § 655.606 Higher cost materials.

The use of signing, pavement marking, and signal materials (or equipment) having distinctive performance characteristics, but costing more than other materials (or equipment) commonly used may be approved by the FHWA Division Administrator when the specific use proposed is considered to be in the public interest.

### § 655.607 Funding.

(a) *Federal-aid highways.* (1) Funds apportioned or allocated under 23 U.S.C. 104(b) are eligible to participate in projects to install traffic control devices in accordance with the MUTCD on newly constructed, reconstructed, resurfaced, restored, or rehabilitated highways, or on existing highways when this work is classified as construction in accordance with 23 U.S.C. 101(a). Federal-aid highway funds for eligible pavement markings and traffic control signalization may amount to 100 percent of the construction cost. Federal-aid highway funds apportioned or allocated under other sections of 23 U.S.C. are eligible for participation in improvements conforming to the MUTCD in accordance with the provisions of applicable program regulations and directives.

(2) Traffic control devices are eligible, in keeping with paragraph (a)(1) of this section, provided that the work is classified as construction in accordance with 23 U.S.C. 101(a) and the State or local agency has a policy acceptable to the FHWA Division Administrator for selecting traffic control devices material or equipment based on items such as cost, traffic volumes, safety, and expected service life. The State's

policy should provide for cost-effective selection of materials which will provide for substantial service life taking into account expected and necessary routine maintenance. For these purposes, effectiveness would normally be measured in terms of durability, service life and/or performance of the material. Specific projects including material or equipment selection shall be developed in accordance with this policy. Proposed work may be approved on a project-by-project basis when the work is (i) clearly warranted, (ii) on a Federal-aid system, (iii) clearly identified by site, (iv) substantial in nature, and (v) of sufficient magnitude at any given location to warrant Federal-aid participation as a construction item.

(3) The method of accomplishing the work will be in accordance with 23 CFR part 635, subpart A, Contract Procedures.

(b) *Off-system highways.* Certain Federal-aid highway funds are eligible to participate in traffic control device improvement projects on off-system highways. In addition, Federal-aid highway funds apportioned or allocated in 23 U.S.C. are eligible for the installation of traffic control devices on any public road not on the Federal-aid system when the installation is directly related to a traffic improvement project on a Federal-aid system route.

### APPENDIX TO SUBPART F OF PART 655— ALTERNATE METHOD OF DETERMINING THE COLOR OF RETROREFLECTIVE SIGN MATERIALS AND PAVEMENT MARKING MATERIALS

1. Although the FHWA Color Tolerance Charts depreciate the use of spectrophotometers or accurate tristimulus colorimeters for measuring the daytime color of retroreflective materials, recent testing has determined that 0/45 or 45/0 spectroradiometers and tristimulus colorimeters have proved that the measurements can be considered reliable and may be used.

2. The daytime color of non-fluorescent retroreflective materials may be measured in accordance with ASTM Test Method E1349, "Standard Test Method for Reflectance Factor and Color by Spectrophotometry Using Bidirectional Geometry" or ASTM Test Method E 1347 (Replaces E97), "Standard Test Method for Color and Color-Difference Measurement by

Tristimulus (Filter) Colorimetry.” The latter test method specified bidirectional geometry for the measurement of retroreflective materials. The geometric conditions to be used in both test methods are 0/45 or 45/0 circumferential illumination or viewing. Uniplanar geometry is not recommended for material types IV or higher (designated microprismatic). The CIE standard illuminant used in computing the colorimetric coordinates shall be  $D_{65}$  and the 2 Degree Standard CIE observer shall be used.

3. For fluorescent retroreflective materials ASTM E991 may be used to determine the chromaticity provided that the  $D_{65}$  illumination meets the requirements of E 991. This practice, however, allows only the total luminous factor to be measured. The fluorescent luminous factor must be determined using bispectral fluorescent colorimetry. Commercial instruments are available which allow such determination. Some testing laboratories are also equipped to perform these measurements.

4. For nighttime measurements CIE Standard Illuminant A shall be used in computing the colorimetric coordinates and the 2 Degree Standard CIE Observer shall be used.

5. Average performance sheeting is identified as Types I and II sheeting and high performance sheeting is identified as Type III. Super-high intensity sheeting is identified as Types V, VI, and VII in ASTM D 4956.

6. The following nine tables depict the 1931 CIE Chromaticity Diagram x and y coordinates for the corner points defining the recommended color boxes in the diagram and the daytime luminance factors for those colors. Lines drawn between these corner points specify the limits of the chromaticity allowed in the 1931 Chromaticity Diagram. Color coordinates of samples that lie within these lines are acceptable. For blue and green colors the spectrum locus is the defining limit between the corner points located on the spectrum locus:

TABLE 1 TO APPENDIX TO PART 655, SUBPART F—DAYTIME COLOR SPECIFICATION LIMITS FOR RETROREFLECTIVE MATERIAL WITH CIE 2° STANDARD OBSERVER AND 45/0 (0/45) GEOMETRY AND CIE STANDARD ILLUMINANT  $D_{65}$ .

Color	Chromaticity Coordinates							
	1		2		3		4	
	x	y	x	y	y	x	x	y
White .....	0.303	0.300	0.368	0.366	0.340	0.393	0.274	0.329
Red .....	0.648	0.351	0.735	0.265	0.629	0.281	0.565	0.346
Orange .....	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Brown .....	0.430	0.340	0.430	0.390	0.518	0.434	0.570	0.382
Yellow .....	0.498	0.412	0.557	0.442	0.479	0.520	0.438	0.472
Green .....	0.026	0.399	0.166	0.364	0.286	0.446	0.207	0.771
Blue .....	0.078	0.171	0.150	0.220	0.210	0.160	0.137	0.038
Light Blue .....	0.180	0.260	0.240	0.300	0.270	0.260	0.230	0.200
Purple .....	0.302	0.064	0.310	0.210	0.380	0.255	0.468	0.140

TABLE 1A TO APPENDIX TO PART 655, SUBPART F—DAYTIME LUMINANCE FACTORS (%) FOR RETROREFLECTIVE MATERIAL WITH CIE 2° STANDARD OBSERVER AND 45/0 (0/45) GEOMETRY AND CIE STANDARD ILLUMINANT  $D_{65}$ .

Color	Daytime Luminance Factor (Y %) by ASTM Type					
	Types I, II, III and VI		Types IV, VII, and VIII		Type V	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
White .....	27	.....	40	.....	15	.....
Red .....	2.5	12	3.0	15	2.5	11
Orange .....	14	30	12	30	7.0	25
Brown .....	4.0	9.0	1.0	6.0	1.0	9.0
Yellow .....	15	45	24	45	12	30
Green .....	3.0	9.0	3.0	12	2.5	11
Blue .....	1.0	10	1.0	10	1.0	10
Light Blue .....	12	40	18	40	8.0	25
Purple .....	2.0	10	2.0	10	2.0	10

TABLE 2 TO APPENDIX TO PART 655, SUBPART F—NIGHTTIME COLOR SPECIFICATION LIMITS FOR RETROREFLECTIVE MATERIAL WITH CIE 2° STANDARD OBSERVER AND OBSERVATION ANGLE OF 0.33°, ENTRANCE ANGLE OF +5° AND CIE STANDARD ILLUMINANT A.

Color	Chromaticity Coordinates							
	1		2		3		4	
	x	y	x	y	x	y	x	y
White .....	0.475	0.452	0.360	0.415	0.392	0.370	0.515	0.409
Red .....	0.650	0.348	0.620	0.348	0.712	0.2550	0.735	0.265
Orange .....	0.595	0.405	0.565	0.405	0.613	0.355	0.643	0.355
Brown .....	0.595	0.405	0.540	0.405	0.570	0.365	0.643	0.355
Yellow .....	0.513	0.487	0.500	0.4700	0.545	0.425	0.572	0.425
Green .....	0.007	0.570	0.200	0.500	0.322	0.590	0.193	0.782
Blue .....	0.033	0.370	0.180	0.370	0.230	0.240	0.091	0.133
Purple .....	0.355	0.088	0.385	0.288	0.500	0.350	0.635	0.221
Light Blue .....	Chromaticity coordinates are yet to be determined.							

NOTE: Materials used as High-Conspicuity, Retroreflective Traffic Signage Materials shall meet the requirements for Daytime Color Specification Limits, Daytime Luminance Factors and Nighttime Color Specification Limits for Fluorescent Retroreflective Material, as described in Tables 3, 3a, and 4, throughout the service life of the sign.

TABLE 3 TO APPENDIX TO PART 655, SUBPART F—DAYTIME COLOR SPECIFICATION LIMITS FOR FLUORESCENT RETROREFLECTIVE MATERIAL WITH CIE 2° STANDARD OBSERVER AND 45/0 (0/45) GEOMETRY AND CIE STANDARD ILLUMINANT D<sub>65</sub>.

Color	Chromaticity Coordinates							
	1		2		3		4	
	x	y	x	y	x	y	x	y
Fluorescent Orange .....	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355
Fluorescent Yellow .....	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442
Fluorescent Yellow-Green .....	0.387	0.610	0.369	.546	.428	.496	0.460	0.540
Fluorescent Green .....	0.210	0.770	0.232	0.656	0.320	0.590	0.320	0.675
Fluorescent Pink .....	0.450	0.270	0.590	0.350	0.644	0.290	0.536	0.230
Fluorescent Red .....	0.666	0.334	0.613	0.333	0.671	0.275	0.735	0.265

TABLE 3A TO APPENDIX TO PART 655, SUBPART F—DAYTIME LUMINANCE FACTORS (%) FOR FLUORESCENT RETROREFLECTIVE MATERIAL WITH CIE 2° STANDARD OBSERVER AND 45/0 (0/45) GEOMETRY AND CIE STANDARD ILLUMINANT D<sub>65</sub>.

Color	Luminance Factor Limits (Y)		
	Min	Max	Y <sub>F</sub> *
Fluorescent Orange .....	25	None	15
Fluorescent Yellow .....	45	None	20
Fluorescent Yellow-Green .....	60	None	20
Fluorescent Green .....	20	30	12
Fluorescent Pink .....	25	None	15
Fluorescent Red .....	20	30	15

\*Fluorescence luminance factors (YF) are typical values, and are provided for quality assurance purposes only. YF shall not be used as a measure of performance during service.

TABLE 4 TO APPENDIX TO PART 655, SUBPART F—NIGHTTIME COLOR SPECIFICATION LIMITS FOR FLUORESCENT RETROREFLECTIVE MATERIAL WITH CIE 2° STANDARD OBSERVER AND OBSERVATION ANGLE OF 0.33°, ENTRANCE ANGLE OF +5° AND CIE STANDARD ILLUMINANT A.

Color	Chromaticity Coordinates							
	1		2		3		4	
	x	y	x	y	x	y	x	y
Fluorescent Orange .....	0.625	0.375	0.589	0.376	0.636	0.330	0.669	0.331
Fluorescent Yellow .....	0.554	0.445	0.526	0.437	0.569	0.394	0.610	0.390
Fluorescent Yellow-Green .....	0.480	0.520	0.473	0.490	0.523	0.440	0.550	0.449
Fluorescent Green .....	0.007	0.570	0.200	0.500	0.322	0.590	0.193	0.782

TABLE 4 TO APPENDIX TO PART 655, SUBPART F—NIGHTTIME COLOR SPECIFICATION LIMITS FOR FLUORESCENT RETROREFLECTIVE MATERIAL WITH CIE 2° STANDARD OBSERVER AND OBSERVATION ANGLE OF 0.33°, ENTRANCE ANGLE OF +5° AND CIE STANDARD ILLUMINANT A.—Continued

Color	Chromaticity Coordinates							
	1		2		3		4	
	x	y	x	y	x	y	x	y
Fluorescent Red .....	0.680	0.320	0.645	0.320	0.712	0.253	0.735	0.265

TABLE 5 TO APPENDIX TO PART 655, SUBPART F—DAYTIME COLOR SPECIFICATION LIMITS FOR RETROREFLECTIVE PAVEMENT MARKING MATERIAL WITH CIE 2° STANDARD OBSERVER AND 45/0 (0/45) GEOMETRY AND CIE STANDARD ILLUMINANT D<sub>65</sub>.

Color	Chromaticity Coordinates							
	1		2		3		4	
	x	y	x	y	x	y	x	y
White .....	0.355	0.355	0.305	0.305	0.285	0.325	0.335	0.375
Yellow .....	0.560	0.440	0.490	0.510	0.420	0.440	0.460	0.400
Red .....	0.480	0.300	0.690	0.315	0.620	0.380	0.480	0.360
Blue .....	0.105	0.100	0.220	0.180	0.200	0.260	0.060	0.220
Purple .....	0.300	0.064	0.309	0.260	0.362	0.295	0.475	0.144

TABLE 5A TO PART 655, SUBPART F—DAYTIME LUMINANCE FACTORS (%) FOR RETROREFLECTIVE PAVEMENT MARKING MATERIAL WITH CIE 2° STANDARD OBSERVER AND 45/0 (0/45) GEOMETRY AND CIE STANDARD ILLUMINANT D<sub>65</sub>.

Color	Luminance Factor (Y%)	
	Minimum	Maximum
White .....	35	
Yellow .....	25	
Red .....	6	15
Blue .....	5	14
Purple .....	5	15

TABLE 6 TO APPENDIX TO PART 655, SUBPART F—NIGHTTIME COLOR SPECIFICATION LIMITS FOR RETROREFLECTIVE PAVEMENT MARKING MATERIAL WITH CIE 2° STANDARD OBSERVER, OBSERVATION ANGLE OF 1.05°, ENTRANCE ANGLE OF +88.76° AND CIE STANDARD ILLUMINANT A.

Color	Chromaticity Coordinates							
	1		2		3		4	
	x	y	x	y	x	y	x	y
White .....	0.480	0.410	0.430	0.380	0.405	0.405	0.455	0.435
Yellow .....	0.575	0.425	0.508	0.415	0.473	0.453	0.510	0.490
Purple .....	0.338	0.080	0.425	0.365	0.470	0.385	0.635	0.221

NOTE: Luminance factors for retroreflective pavement marking materials are for materials as they are intended to be used. For paint products, that means inclusion of glass beads and/or other retroreflective components.

[67 FR 49572, July 31, 2002, as amended at 67 FR 70163, Nov. 21, 2002; 68 FR 65582, 65583, Nov. 20, 2003; 74 FR 66862, 66863, Dec. 16, 2009]

EDITORIAL NOTE: At 74 FR 66862, Dec. 16, 2009, the appendix to subpart F was amended in Table 3 by revising the daytime chromaticity coordinates for the color Fluorescent Pink; however, the amendment could not be incorporated due to inaccurate amendatory instruction.

## Subpart G [Reserved]

## PART 656—CARPOOL AND VANPOOL PROJECTS

- Sec.  
656.1 Purpose.  
656.3 Policy.  
656.5 Eligibility.  
656.7 Determination of an exception.